Applicant : Shackleford, J. Barry
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REMARKS

In the Office Action mailed September 7, 2004 the Examiner rejected claims 10-18 as directed to non-statutory subject matter under 35 USC 101 citing that "...manipulating a particular circuit embedded in a computer..." is no where to be found. Applicant respectfully submits that there are no magic words or other particular language required to have proper subject matter. Instead, the proper inquiry is to review "the claimed subject matter as a whole" and determine that it is not a "disembodied mathematical concept", "law of nature", "natural phenomenon", or "abstract idea."

In the instant case, claim 10 recites that it is directed towards "determining the fitness of a potential solution for a combinatorial genetic algorithm problem" using "a solution register", "a plurality of data tables" and "an adder". The combinatorial genetic algorithm problem concerns a class of problems involved with ordering or routing such as in the traveling salesman problem or TSP (pg. 7, lines 17-30) to find a minimum distance or route. Clearly, finding the closest distance between two points is necessary for all forms of travel and produces "a useful, concrete, and tangible result" and is not a disembodied mathematical concept. Of course, claim 10 also has many other physical and tangible uses but only one is needed to show it is proper subject matter.

Further, claim 10-18 are not to be implemented with pencil and paper as the Examiner has suggested. The language in claim 10 recites "a solution register", "data tables" and "adder" in the context of a genetic algorithm (GA) machine as represented schematically in FIG. 3 and

the fitness circuit portion of the GA machine depicted in FIG. 4, FIG. 5 and FIG. 6. These terms are also mentioned in a similar light in one or more places in the application (see for example: pg. 7, lines 11-16; pg. 7, lines 31-34; pg. 8, lines 1-15). Clearly, the Applicant has adequately defined these terms as relating to a GA machine implemented in hardware and software and not using pencil and paper. Accordingly, it is inappropriate for the Examiner to introduce extrinsic evidence (i.e. a Webster's dictionary definition) to define the term register as "a written record containing regular entries of items or details" as this contradicts the Applicant's definition of "register" per the claims, specification language and figures provided in the application as filed.

For at least these reason's, Applicant respectfully submits the rejection under 35 USC 101 is improper and should be withdrawn.

Regarding claims 3 and 18, the Examiner has rejected these claims under 35 USC 112, first paragraph for allegedly failing enablement. Specifically, the Examiner asserts that page 11, lines 1-2 indicates the addition is done in serial rather than in parallel as recited in claim 3. Regarding page 11, line 1-2 mentioned by the Examiner, this reference indicates the "particular distance a traveler must make to visit all of the cities in that order" and refers to the way in which a person must travel "in order" from city to city. Unfortunately, the Examiner has improperly interpreted the phrase "in order" out of context. One skilled in the art reading page 11, line 1-2 would understand this does not describe the operation of an adder but merely the reality that travel between cities and other similar class of problems occur as a sequence of

events. Conversely, the example adder depicted in FIG. 4 and recited in claim 3 unambiguously operates in a parallel (i.e., distance table RAM 421-428 each have an input to adder 430 rather than sharing an input to adder 430 using a MUX or other device). It is also mentioned later that adder 430 in FIG. 4 operates in parallel at page10, line 33. Thus, page 11, lines 1-2 do not support the Examiner's assertion of ambiguity. Instead, Applicant respectfully submits that one skilled in the art would clearly see FIG. 4 and references in the specification satisfy 35 USC 112, first paragraph for claim 3.

The Examiner also asserts that claim 18 fails enablement under 35 USC 112, first paragraph because the changing out the fitness function or matrix of partial solutions was not addressed. This is also clearly an incorrect assertion with no support. Those skilled in the art of GA machines know how to change a fitness function and corresponding data depending on the particular genetic algorithm problem. Applicant has indicated a novel and non-obvious approach of using "another matrix of partial solutions" as recited in claim 18 however the process of using another dataset or fitness fucntion in a GA machine need not extensive explanation. Those skilled in the art know that different datasets and fitness functions allow a GA machine to solve different problems.

In addition, the Applicant notes that a matrix of partial solutions is described at least on page 9, lines 4 to 34, page 10, lines 1-34, FIG. 4, FIG. 5, FIG. 6 and elsewhere in the application. Consequently, one skilled in the art would readily understand the meaning of the word 'matrix' in claim 18 corresponds to the terms 'grid' or 'table' as used in the specification and therefore understand this teaching as well. Merely using a different term does not create an enablement issue as long as one skilled in the art could practice the invention.

Likewise, the specification clearly teaches one skilled in the art that a matrix of partial solutions would result when connecting a matrix to one part of a register having a complete 'solution' as disclosed in FIG. 4 and on at least page 8, lines 4-16. For example, distance table RAM 420 is table or matrix of partial solutions containing smaller tables or matrices depicted as distance table RAM 421-428. The address of a potential solution is contained in register 410 and divided into partial addresses and, upon lookup in the multiple distance table RAM 421-428, into partial solutions as recited in claim 3 and 18. These partial solutions retrieved from the tables or matrices are added in parallel using adder 430 to produce a fitness value. This is consistent with a more concrete example of the fitness function operation and possible solution provided on pg. 9, lines 28-34 and page 10, lines 1-34.

For at least the reasons provided above, the Application requests that the Examiner also withdraw this rejection under 35 USC 112 first paragraph regarding claim 3 and claim 18.

Regarding substantive rejections, the Examiner rejected claims 1-18 under 35 USC 102(e) as anticipated by Shackleford (US Pat. 6,185,547). Specifically, the Examiner cites FIG. 7; Col. 4, lines 63-64 of Shackleford as generally describing a plurality of component parts. Applicant respectfully submits that the Examiner's assertion is incorrect as this portion of Shackleford describes a 'least-fit chromosome register' portion of a GA architecture and not the 'fitness function' circuitry as recited in claim 1. These are two distinct parts of a GA machine and one skilled in the art would recognize them as being different and not interchangeable. If the Examiner were to interchange or use the 'least-fit chromosome register' as a fitness function then the GA machine would unequivocally fail to produce the expected results.

Contrary to the Examiner's assertion, a 'least-fit chromosome register' is not a 'solution register'. By the Examiner's own admission, "least-fit chromosome hold circuit 91 is part of the selector 40" (Office Action, pg. 14, paragraph 3) but clearly not a solution register. In Shackleford, the 'least-fit chromosome register' is one type of register used to hold one of two parent chromosomes from first and second chromosome registers 41 and 42 with a lower fitness value. Each parent chromosome is assigned a fitness value to indicate a relative strength or

weakness if it were used as solution however they do not represent a solution until they are combined or further processed. Specifically, the two parent chromosomes from first and second chromosome registers 41 and 42 cannot be solutions until they are potentially crossed over in cross over circuit and/or mutated (FIG. 1).

The parent with the lower fitness value is always kept in the 'least-fit chromosome register' to expedite replacement of the least-fit parent chromosome with a more fit (i.e., higher fitness value) assigned to a resulting child chromosome. By repeating this process over many iterations, the least-fit chromosomes are discarded and the best-fit solution is presented.

Despite the title of "Fitness Function Circuit" in Shackleford, this should not be interpreted to mean that there is only one fitness function circuit as the Examiner has suggested. To assume that all fitness function circuits are the same is to miss the point of the GA machine and technology. In fact, it is well known by those skilled in the art that each different problem requires a different fitness function circuit to properly evaluate a potential chromosome or solution. The fitness function is therefore tailored to solve a specific problem or class of problems and cannot necessarily be reused for a different class of problems. For example, Shackleford suggests a fitness function for solving set coverage type of problems and not

combinatorial genetic algorithm problems (Col. 25, lines 14-16). Specifically, Shackleford states:

> "Another embodiment of the present invention is a problem-specific fitness function circuit for solving a set covering problem"

The set coverage type of problem attempts to select a minimum set of events to perform a set of operations when each event may perform one or more operations and events may share one or more operations in common. For example, testing a DRAM may require expensive chip testing equipment to perform 100 or more different tests. While the 100 or more different tests can not all be performed at the same time, they can be performed in different groups. If all the groups of tests are performed then some of the tests will be performed multiple times which is unnecessary and wasteful of the testing machine cycles. Accordingly, the fitness function in Shackleford identifies the smallest group of tests to be performed while getting all of the 100 tests completed; this is a set coverage problem as applied to testing DRAM.

Unfortunately, the Examiner has incorrectly read Shackleford to teach a fitness function that uses "a plurality of data tables....each of said data tables comprising a matrix of partial solutions to said combinatorial genetic algorithm problem" as recited in claim 1, claim 10 and claim 18. Instead, the fitness function in Shackleford depicted in FIG. 28 and described on Col. 26, lines 19-67 and Col. 27, lines 1-67 describe an entirely different fitness function that

provides entirely different analysis for an entirely different problem (i.e., solving a set coverage problem and not a combinatorial genetic algorithm problem as recited in claims 1-18).

Further, the Examiner has indicated that Shackleford teaches a GA framework at Col. 25, lines 23-24 that "inputs n-bit chromosomes and outputs their evaluated values of fitness" and concludes "A genetic algorithm is axiomatically combinatorial". Even if both of these statements were true, the Examiner must show the Shackelford teaches each and every element and not just one, two or several for a proper § 102 rejection. Clearly, the Examiner has not shown each and every element has been taught and therefore failed to establish the prima facie case. See Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 U.S.P.Q.2D (BNA) 1913, 1920 (Fed. Cir.), cert. denied, 493 U.S. 853, 107 L. Ed. 2d 112, 110 S. Ct. 154 (1989) (explaining that an invention is anticipated if every element of the claimed invention, including all claim limitations, is shown in a single prior art reference). See Jamesbury Corp. v. Litton Industrial Products, Inc., 756 F.2d 1556, 1560, 225 USPQ 253, 256 (Fed. Cir. 1985) (explaining that the identical invention must be shown in as complete detail as is contained in the patent claim). See Verdegaal Bros., Inc. v. Union Oil Co., 814 F.2d 628, 631, 2 U.S.P.Q.2D (BNA) 1051, 1053 (Fed. Cir. 1987) (explaining that a prior art reference anticipates a claim only if the reference discloses, either expressly or inherently, every limitation of the claim). See Kloster Speedsteel

AB v. Crucible, Inc., 793 F.2d 1565, 1571, 230 U.S.P.Q. (BNA) 81, 84 (Fed. Cir. 1986) ("Absence from the reference of any claimed element negates anticipation.")

Accordingly, the Examiner has not shown that Shackleford teaches each and every element of claims 1 and must therefore withdraw the final rejection and allow at least this claim. For example, the Examiner has not indicated where Shackleford teaches or even suggests a fitness function that uses:

> a plurality of data tables, the number of data tables corresponding to the number of said component parts of said solution register, respective data tables having inputs from two respective ones of said component parts of said solution register, each of said data tables comprising a matrix of partial solutions to said combinatorial genetic algorithm problem, the two respective ones of said component parts determining a particular respective partial solution, each of said matrices having identical entries therein; and
>
> an adder connected to each of said plurality of data tables, said adder adding respective partial solutions from each of said plurality of data tables, thereby determining the fitness of said potential solution for said combinatorial genetic algorithm problem.

The combinatorial genetic algorithm problem is a class of problems the fitness function in claims 1 solves but is clearly not the only limitation claimed. Accordingly, it is not sufficient to focus on this one limitation when Shackleford fails to provide all the other limitations described in claim 1. Clearly, even if Shackleford did provide a solution to a combinatorial genetic algorithm problem it would not teach or suggest the fitness function as recited in claim 1.

For at least this reason, Shackleford does not anticipate claim 1 as amended.

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Applicant respectively submits that claims 2-9, while allowable on their own accord, depend from claim 1 and therefore are also in condition for allowance for at least the same reasons as claim 1.

Independent claims 10 and 16 concern determining the fitness for a "combinatorial genetic algorithm problem" and for at least the same reasons as claim 1 also are in condition for allowance. Specifically, the Examiner has failed to point out where Shackleford teaches or even suggests as recited in claim 10:

> inputting a plurality of potential solution values into a solution register, said solution register comprising a plurality of component parts thereof;
> receiving, after said step of inputting, at each of a plurality of data tables two respective ones of said component parts of said solution register, the number of data tables corresponding to the number of said component parts of said solution register, each of said data tables comprising a matrix of partial solutions to said combinatorial genetic algorithm problem, each of the matrices having identical entries therein;
> indexing said matrices of partial solutions to said genetic algorithm within said plurality of data tables, the two respective ones of said component parts determining respective particular partial solutions within the respective matrices; and adding, by an adder connected to each of the respective data tables, respective outputs from each of said data tables, whereby the sum of said adder determines the fitness of said potential solution for said combinatorial genetic algorithm problem.

Or as recited in claim 16, the Examiner has also failed to point out where Shackleford teaches or even suggests:

(a) inputting a plurality of potential solution values into a solution register, said solution register comprising a plurality of component parts thereof;
(b) receiving, substantially simultaneously, at each of a plurality of data tables two respective ones of said component parts of said solution register, the number of data tables corresponding to the number of said component parts of said solution register, each of said data tables comprising a matrix of partial solutions specific to said genetic algorithm problem, each of the matrices having identical entries therein;
(c) indexing said matrices of partial solutions to said genetic algorithm within said plurality of data tables, the two respective ones of said component parts determining respective particular partial solutions within the respective matrices;
(d) adding, by an adder connected to each of the respective data tables, respective outputs from each of said data tables in parallel, whereby the sum of said adder determines the fitness of said particular potential solution for said genetic algorithm problem;
(e) comparing the fitness of said particular potential solution to a fitness threshold; and
(f) replacing a prior potential solution from said pool of potential solutions with said particular potential solution if said fitness of said particular potential solution exceeds said fitness threshold, and otherwise deleting said particular potential solution.

As previously discussed, the Examiner must show the Shackelford teaches each and every element and not just one, two or several for a proper § 102 rejection. If the Examiner does not, the prima facie case has not been established and the claims must be allowed. In the instant case, the Examiner has only argued that "a genetic algorithm is axiomatically combinatorial" but has failed to even attempt to show where Shackleford teaches or suggests any other limitations in the claims. Even if the Examiner's assertion that genetic algorithms were axiomatically

combinatorial, this would not be sufficient for a § 102 rejection. Accordingly, the final rejection must be withdrawn and claims 10 and 16 allowed. Further, dependant claims 11-15 and 17-18 depend from independent claims 10 and 16, and while also allowable on their own, are in conditional for allowance by virtue of their dependence on allowable independent claims 10 and 16.

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Included above hereto is a current version of the claims at the time of this amendment for reference. The above page is captioned "**Current Version**".

Applicant believes the Final Rejection is premature and should be withdrawn as a prima facie case for rejecting the claims has not been established. In the event the Examiner does not wish to withdraw this Final Rejection, the Applicant is prepared to appeal this case and has included a Notice of Appeal pursuant to this endeavor.

The Applicant has made a diligent effort to place the claims in condition for allowance, should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Leland Wiesner, Applicants' Attorney at (650) 853-1113 so that such issues may be resolved as expeditiously as possible.

For these reasons provided above, this application is now considered to be in condition for allowance and such action is earnestly solicited.

Respectfully Submitted,

Leland Wiesner

January 7, 2005
Date

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